polysaccharides of commercial interest, deals with algal polysaccharides, plant gums, cellulose derivatives, and microbial polysaccharides, including xanthan gum and dextran.

The book is well produced, tidily laid out, well and clearly printed, and provided with excellently drafted diagrams and structures. There are few typographical slips. The Figures and Tables clarify the text, and do not merely decorate the pages.

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Mucopolysaccharides—Glycosaminoglycans—of Body Fluids in Health and Disease, by RAJENDRA VARMA AND RANBIR S. VARMA, Walter de Gruyter, Berlin and New York, 1983, xv + 622 pages + Subject Index, DM 290.00

As explained in the Preface, this monograph attempts to bring together, for the first time in one volume, information concerning a diverse group of macromolecules, the glycosaminoglycans (GAG) and their degradation products, from a variety of biological sources, for the benefit of scientists and physicians. The result of this endeavor is a massive survey of the qualitative and quantitative occurrence of GAG in tissues and body fluids in normal and diseased states. The material is organized in terms of systems and organs, with intentional overlap resulting from the ubiquitous occurrence of these compounds. The book is intended as a reference volume, and there is no attempt to integrate the facts into a unifying hypothesis of GAG function. When appropriate, the occurrence of related classes of glycoconjugates, such as glycoproteins, is included in the discussion. However, theories to explain the significance of this common occurrence are not presented. Each chapter is followed by an extensive bibliography of references, which are titled, numbered, and arranged in alphabetical order. Thus, Chapter Two, on methods of isolation and analysis, has 21 pages of text, and is followed by 15 pages of bibliography. Usually, the authors have chosen to refer to the name of the first author and the date of publication. However, occasionally, the numbers of the references are cited instead.

The major achievement of the authors has been an ambitious compilation of data surveying the types of GAG found in body fluids, their composition in terms of neutral sugars, hexosamines, sulfate, and protein (percentages or ratios), co-occurrence of sialic acids, and relative proportions of the major classes of GAG, together with the methods of extraction and analysis employed in each case. Often, the authors have included useful, brief reviews of the associated physiology or pathology, with ideas about the probable function of the GAG. Good examples of the latter are found in the sections on the eye (Chapter 7) and ear (Chapter 10; see discussion of hypothyroidism and hearing loss).

Throughout the book, documentation is usually very thorough. This is especially true for the chapter on mucous secretions (Chapter 6), but it can be uneven, particularly in Chapter 2, when discussing methods of isolation and fractionation. Whereas some procedures are given a large number of references, others receive none; this is unfortunate, because, in most cases, the experimental methods provided are not detailed enough for reproduction without reference to the original article. A strange feature, found here and throughout the book, is the inclusion of a very large number of literature references from the 1960's and early 1970's, some cited repeatedly, whereas there are very few citations from the late 1970's, and none after 1979. (On page 522, a 1978 reference is described as "recent work".) This leaves the reader with the mistaken impression that there has been a lack of recent interest in the GAG, which is certainly not the case, and is surprising in view of the authors' reference in the Preface to "The comprehensive, up-to-date review of the literature . . ." Although most of the book is written in easily readable style, the sections on biosynthesis and catabolism (Chapter 1) are similar to "Annual Reviews", and consist of brief, uncritical summaries of literature findings. This particular style leads to sequences of very short paragraphs, with a good deal of switching between subjects, and some organizational problems, particularly in the treatment of biosynthesis, and of the effects of vitamins and hormones.

After the early chapters on GAG biochemistry and analysis, Chapter 3 discusses biological functions and therapeutic uses, but there is only a very brief mention of the anticoagulant properties of heparin, and no mention of antitumor activity. One of the most satisfying chapters is that on amniotic fluid, which includes a detailed account of the role of GAG analysis in prenatal diagnosis of the mucopolysaccharide-storage diseases, with a critical evaluation of the advantages and limitations of this method. The lysosomal storage diseases also feature prominently in the long chapters on GAG in blood (No. 16) and urine (No. 17, with 346 references). However, because of the lack of recent literature coverage, there is almost no mention of l.c. under elevated pressure, which is rapidly emerging as the method of choice for the detection and monitoring of carbohydrates excreted in these diseases. The chapters on blood and urine each contain very comprehensive compilations of data regarding GAG in "normal" states (age, growth, and sex-related; pregnancy, effects of drugs, vitamins, stress-related) and pathological states (rheumatic disorders, infections, skin diseases including scleroderma, diabetes mellitus, thyroid, renal, and hepatic disorders, cystic fibrosis, cardiovascular disorders, and carcinoma). The urine chapter also includes mention of a large number of rare "named" syndromes, a discussion of skeletal disorders, and, as already mentioned, a treatment of carbohydrate-storage diseases, including correlations of GAG levels (expressed relative to creatinine or to body weight; see discussion on page 523), or of ratios of GAG species, with pathology and therapy. The importance of the latter for diagnosis, screening, and monitoring is emphasized. Other chapters deal with the gastrointestinal and respiratory tracts, the

mouth, embryonic membranes, synovial fluid, cysts and effusions, the reproductive system, cerebrospinal fluid, and skin.

This book is clearly printed, on high-quality paper, with wide margins, and plenty of white pages, *e.g.*, between chapters. There are a few errors, such as the repeated use of "technics" instead of "techniques", an apparent error in the formulas on page 72, a lack of hyphens (*e.g.*, the heading on page 95), "messed out" (page 322), a problem with regard to pre- and ante-natal diagnosis (Section 11.6), "aspartic acid" instead of "asparagine" in Table 1, interchanging of chondroitin 4- and 6-sulfate (Fig. 1-1.), and, apparently, a missing heading (page 16). Occasionally, there are some aberrations in the English style, such as use of an inappropriate tense, or excessive use of the definite article (see example on page 243).

This book will be useful as a comprehensive data source for scientific and medical libraries, and for research laboratories, and, particularly, for an individual starting research into GAG who needs access to the enormous reservoir of literature references on this important and ubiquitous class of biopolymer.

It is relevant to note that these authors recently edited *Glycosaminoglycans and Proteoglycans in Physiological and Pathological Processes of Body Systems,* reviewed by Martin I. Horowitz, *Carbohydr. Res.*, 115 (1983) C7–C8.

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Biochemical Engineering and Biotechnology Handbook, by BERNARD ATKINSON AND FERDA MAVITUNA, Nature Press, New York, 1983, 1119 pages, £50.

Biochemical engineering is a comparatively new subject title, created to facilitate studies of the special engineering techniques necessary for the handling of biological entities–chemicals, waste materials, and organisms. What is included under the subject title of biochemical engineering has recently been enlarged with the innovation of the supposedly all-important term biotechnology. However, this situation has resulted in a more diffuse subject area, and therefore, one may wonder just what this book's title really means.

There has been a need for some time for a new general book on Biochemical Engineering. That place has so far been fulfilled by the well known books of Blakebrough, and of Aiba, Humphrey, and Millis, but, for the past ten years, no other books as useful have appeared.

The tendency nowadays is for publishers to present the "Advances", "Proceedings", or "Reviews" type of volumes, which concentrate on a limited number of very specific subjects, often without giving adequate background-information. The alternative, frequently used, form of publication–the multi-volume treatise–although having real interest, is completely out of reach for the individual, and even for some libraries, owing to the exaggerated cost.